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I

THE USE OF STANDARD ARITHMETIC TESTS

Up until about ten years ago the only way we had of rating pupils was by class grades, monthly test grades, and examination grades. These measures did not give a standard by which to judge pupils, because of the variety of opinions of different teachers. Educators saw this inefficiency and set about to devise a series of standardized tests and scales which would give teachers and superintendents standards of measurement by which a school or school system could be measured.

"This movement is, as yet, almost in its infancy," says Professor Cubberley,[1] "but so important is it in terms of the future of school administration that it already bids fair to change, in the course of time, the whole character of this professional service. The significance of these new standards of measurement for our educational service is indeed large." Their use means nothing less than the transformation of school work from guess work to scientific accuracy, and the almost entire elimination of the personal feelings of teachers and superintendents in regard to promotion.

These standard tests are divided into two classes—educational tests and intelligence tests. The educational tests are those which measure the achievement in the different elementary subjects, as arithmetic, reading, spelling, handwriting, language, and such high school subjects as algebra, geometry, foreign languages, and physics. According to Terman,[2] "Intelligence tests measure the subject's general intelligence, not his special ability in a particular line. They include tests of memory, language comprehension, size of vocabulary, orientation in time and space, eye-hand co-ordinations, knowledge about familiar things, judgment, ability to find likenesses and differences between common objects, arithmetical reasoning, resourcefulness and ingenuity in difficult practical situations, ability to detect absurdities, apperception, the speed and richness of association of ideas, the power to combine the dissected parts of a form board or a group of ideas into a unitary whole, the capacity to generalize from particulars the ability to deduce a rule from connected facts, etc. These tests provide the most important type of information supplementary to that obtained through educational tests."

Neither educational testing alone nor intelligence testing alone is complete, but when both have been used the teacher has a pretty thorough diagnosis of each case in her class and by carefully working out the results she knows just where her pupils stand. Through the use of these tests a pupil is often found capable of skipping a grade, provided he is given a little added attention and plenty of encouragement.

Educational tests may be used alone to great advantage to test the previous as well as the present teaching and to see just what needs to be stressed most. This is especially true of arithmetic. Not only do these arithmetic tests help the teacher to find her class's weakest point, but the pupils take great interest in finding their own weaknesses. This gives them an incentive to work to reach a normal standard in the matter in question.

Rice was the pioneer in formulating standards in arithmetic. Klapper[3] states that in

[1] Ellwood P. Cubberley.

Editor's Note: This essay received the Dingledine prize for the best graduation essay submitted during the session 1920-1921 at the State Normal School, Harrisonburg, Virginia.

[2] Lewis M. Terman—The Intelligence of School Children. Houghton Mifflin. 1920.

[3] Paul Klapper—The Teaching of Arithmetic.

1902 Rice gave his test questions to about six hundred children of grades 4A through 8B in seventeen schools representing seven cities. The work of the marking was carefully planned, each example being marked (1) correct in principle and work; or (2) correct in principle only; or (3) incorrect. He interpreted his results very carefully and his final conclusions were: "First, that proper supervision of teachers and definitely standardized measures of results are the determining factors in making for efficient work in arithmetic, and second, that these standards of attainment do not permit the teacher to be the judge of her own work, nor the principal to be the judge of the standing of his school or the worth of his teachers." His work was too limited, and the absolute uniform conditions necessary for determining a standard were not secured in each school tested; but his contribution is significant because of the impetus it gave the scientific movement in arithmetic.

Different tests have been worked out since those of Rice, and the tests that are probably most used in arithmetic now are the Courtis Tests and the Cleveland Survey Tests. The aim of these tests is not alone a test of the knowledge of facts taught, but also a measure of the power and habits that result from the work accomplished. These tests show that there is a wide range of abilities of children in the same grade and that only a small per cent of children are up to the grade standard. The pupil's achievement depends not only upon what he knows, but also upon his physical and emotional conditions. The tests also detect the waste in class-room work and thus either cause the teacher to improve her work or result in her having her place taken by a more efficient teacher.

It is important that the teacher think of tests and scales not only as a measure but also as an instrument which will enable her to make her instruction more effective. Therefore every teacher should be anxious to have them given to her pupils or, better still, she should be able to give them herself.

THE EXPERIMENT

On February 3, 1921, the Cleveland Survey Arithmetic Tests were given, by the writer, to the seventh and eighth grades of the Pleasant Hill Junior High School. This is the rural junior high school used by the Harrisonburg State Normal School as a practise school. The writer was teaching arithmetic in the seventh grade at the time the test was given.

The purpose in giving these tests was to find out the quality of work done in the fundamental processes. We wanted to know the general standing of each grade as a whole in the fundamentals of arithmetic. We also wanted to know the individual weaknesses in each of the different types of operations.

Perhaps the best description of the Cleveland Survey Arithmetic Tests[4] is that which appeared in the *Elementary School Journal* for September 1916, page 26. They are called "spiral arithmetic tests because each of the fundamental operations occurs several times: thus, in addition, the simplest exercise consists of adding pairs of two-place figures; the second series consists of short columns of one-place figures; the third series consists of the addition of fractions of like denominators; the fourth series consists of the addition of longer columns of figures; the fifth series consists of the addition of four-place figures which require carrying forward from one column to the next; the addition of fractions of unlike denominators constitutes the final and most elaborate series. Similar spiral tests in subtraction, multiplication, and division are interwoven with the exercises in addition."

These tests are very simple, and anyone who knows anything about tests can give them. A watch with a second hand is needed to keep time, although a stop watch is much better. With the room comfortable and the pupils' desks clear of everything except a copy of the test and a well-sharpened pencil, the teacher is ready to start the test. First of all, the teacher should explain the test and tell the pupils why it is being given. This explanation, if given properly, will remove all disagreeable feelings toward tests and the pupils will become interested and anxious to make high scores. The next thing to be done is to fill out the blanks on the first page with the teacher's help. Now

[4]These tests may be secured from The Public School Publishing Co., Bloomington, Illinois. Price per hundred, $2.90: Sample set, 10 cents.

TABLE I

Showing the seventh and eighth grade medians of Pleasant Hill School along with the St Louis and Grand Rapids medians

	Median of	SCORES FOR EACH SET														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Seventh Grade	P. H. S.	17.5	17.5	16.6	15.5	4.35	5.35	4.5	0.	1.25	4.1	5.5	2.37	2.75	1.16	2.8
	St. L.	28.4	24.2	19.8	22.3	7.4	9.6	6.9	9.7	5.0	5.3	9.7	4.7	4.9	2.0	5.6
	Gr. R.	27.3	20.7	18.8	19.7	7.2	9.6	6.1	7.8	4.1	5.3	8.8	4.5	5.0	1.8	4.6
Eighth Grade	P. H. S.	21.25	17.75	20.25	15.75	6.25	5.5	5.5	2.5	1.5	4.75	4.5	4.5	3.5	1.25	3.5
	St. L.	32.2	28.3	21.9	25.7	8.4	11.3	7.8	12.0	5.8	5.8	11.7	5.3	5.3	2.7	6.6
	Gr. R.	30.3	25.5	20.7	23.0	8.1	11.0	6.8	8.8	4.7	6.5	10.3	4.9	5.7	2.3	4.8

TABLE II

Giving each class's median compared with the St. Louis score, along with a few explanations and tentative decisions

	Name of Set	Class Median		Amount P. H. S. median is higher or lower than St. Louis.		EXPLANATION	TENTATIVE REMARKS
		7	8	7	8		
Addition	A	17.5	21.25	—10.9	—10.95	The use of fingers in some instances hindered progress.	There is need of drill in addition. A thorough mastery of combinations is essential for speed and accuracy.
	E	4.35	6.25	— 3.05	— 1.15		
	J	4.1	4 75	— 1.2	— 1.05		
	M	2 75	3.5	— 2.15	— 1.8		
Subtract'n	B	17.5	17.75	— 6.7	—10.55		
	F	5.35	5.5	— 4.25	— 5.8		Special work in subtraction is needed
Multiplication	C	16.6	20.25	— 3.2	— 1.65		
	G	4.5	5.5	— 2.4	— 2.3		There is need of drill with a great deal of stress put upon accuracy.
	L	2.37	4.5	—11.3	— 0.8		
Division	D	15.5	15.75	— 6.8	— 9.95		Neither class shows up well in division.
	I	1.25	1.5	— 3.75	— 4.3		
	K	5.5	4.5	— 4.2	— 7.2		
	N	1.16	1.25	— 0.84	— 1.45		
Fractions	H	0	2.5	— 9.7	— 9.5	In many cases the low scores were due to wrong methods.	Both classes need to understand the rules for working fractions.
	O	2.8	3.5	— 2.8	— 3.1		

set A is explained so the class will know just what to expect and they should also be shown where to find the set; then with left finger inside first page and pencil in right hand, all are ready to start work when the command, "Go!" is given. After the time allotted to this set is up, the command, "Stop!" is given and papers are closed. This procedure is used for each set in the test. The whole test should not be given the same day, but part given one day and the other part given the next day. This interval of time gives better results, for the pupils do not become so tired either day.

The results obtained from this test will be seen in Table I. The first score represents the medians of the Pleasant Hill School for grade 7A; the second score is the median of the St. Louis schools, and the third that of the Grand Rapids schools. The fourth, fifth and sixth lines present similar eighth grade scores.

Table II shows each class's median compared with the St. Louis median and, along with this, a few conclusions and suggestions. The minus sign preceding each score shows that Pleasant Hill scores are below the scores made at St. Louis.

The results of these tests show that both classes need drill in the simple forms, with a great deal of stress put upon accuracy. There are bad habits which should be broken in some cases, and in others the methods of working must be more thoroughly fixed upon the minds of the pupils.

Table III shows each individual's score compared with the class median, the plus (+) sign meaning that the individual ranks that much above the class median; the minus (—) sign means that his score is that much below the class median.

Beginning immediately after the test had been given, the Studebaker Practise Exercises in arithmetic were used in the seventh grade.

The purpose in giving these practise exercises was to help the class, as well as the individuals, on weak points. These weak places were shown in the results of the test and they were especially stressed during these practises.

The Studebaker Economy Practise Exercises are arranged in a spiral system very much like the Cleveland Survey Arithmetic Tests except that there are more exercises in each of the fundamentals, there being fifty different exercises in a set. Each exercise is placed on a card of ordinary tablet paper size with the examples placed just above openings in the card where the examples may be worked on a paper placed under the card Not only are the examples on these cards suit-

TABLE III

Showing each pupil's scores compared with the class median.

SEVENTH GRADE

Names of Pupils	NAMES OF SETS															
	Addition				Subtraction		Multiplication			Division				Fractions	
	A	E	J	M	B	F	C	G	L	D	I	K	N	H	O
Ru Be__	+1.5	—1.35	—1.1	—2.75	—5.5	—0.35	—0.6	+0.5	—0.37	+1.5	—1.25	+2.5	—0.16	+6.0	+2.2
Ru Bo__	+4.5	+0.65	—0.1	—0.75	—0.5	—2.35	—0.6	+1.5	—1.37	—2.5	+1.75	+1.5	—1.16	0.0	+0.2
Do Ho__	—0.5	—0.35	—0.1	+2.25	+0.5	—0.35	+0.4	—0.5	—0.37	+1.5	—0.25	—3.5	—1.16	0.0	—1.8
Ne Ke__	—4.5	—0.35	—4.1	+0.25	+0.5	—0.35	—0.6	—1.5	—1.37	—0.5	—1.25	—3.5	—0.16	+2.0	+0.2
Jo Ki__		—2.35	—0.1	—2.75		—0.35		—1.5	—2.37		+0.75	—1.5	—0.16	+2.0	—0.8
Me La__	—4.5	—0.35	—2.1	—1.75	—7.5	—0.35	+0.4	+0.5	+1.63	—0.5	—0.25	—0.5	—0.16	0.0	—0.8
Ra My__	+0.5	—0.35	—0.1	+1.25	+2.5	+0.65	—0.6	—1.5	—0.37	+1.5	+2.75	+0.5	+0.84	0.0	—0.8
Pa Th__	—1.5	—2.35	—0.1	—0.75	—8.5	—2.35	—1.6	—1.5	—0.37	—4.5	—1.25	—4.5	—1.16	+1.0	—0.8

EIGHTH GRADE

Names of Pupils	NAMES OF SETS														
	Addition				Subtraction		Multiplication			Division				Fractions	
	A	B	J	M	E	F	C	G	L	D	I	K	N	H	O
Ha Ac__	—5.25	—1.25			+0.25	+0.5	—7.25	—1.5		—0.75					+1.5
Sy La__	+5.85	—0.25	+0.25	+0.5	+3.25	—0.5	+9.75	—0.5	—0.5	—0.75	—1.5	—0.5	—1.25	—2.5	—0.5
Al My__	—3.25	—3.25	—1.75	—0.5	—0.75	—2.5	—2.25	—0.5	—1.5	—0.75	+0.5	—3.5	—0.25	+1.5	—2.5
Ed Sh__	—0.25	+0.75	+1.25	—1.5	+2.25	+1.5	—0.25	—0.5	+0.5	+5.25	+1.5	+4.5	+0.75	—0.5	+2.5
Ja Sh___	—0.25	—0.25	—0.75	+0.5	—0.75	+3.5	—3.25	—1.5	—1.5	+2.25	—1.5	+1.5	—1.25	+9.5	—3.5
Re Sw__	—3.25	—1.25	—0.75	—2.5	—3.75	—3.5	—0.25	+1.5	+0.5	—1.75	—0.5	—3.5	—0.25	—1.5	+0.5

able for the higher grades, but almost all of them may be used from the third grade on to the high school.

A teacher's manual is sent with each set, which gives full instructions as to how to carry on the work and the length of time to be given to the exercises in each of the grades. Individual record blanks also are sent with each set, and on these pupils keep a strict record of each day's work.

These are very valuable exercises in the four fundamentals, and a set should be included in the equipment of every school.[5]

The seventh grade had the Studebaker Practise work for thirty-six days. The amount of time used each day was usually not over eight minutes—four and one-half minutes used in the actual work of the exercise and the rest of the time used in correcting results and recording the scores.

The pupils' record blanks were not used to keep their records on, but an ordinary composition tablet was used instead. Their records took the following form:

STUDEBAKER PRACTISE EXERCISES

No. of Ex.	Date	No. Attempted	No. Right
1	Feb. 22, '21	54	54
5	Feb. 25, '21	41	41

The class as a whole took great interest in this work and often wanted to be allowed more time for it. They learned to watch their records from day to day and took great pride in telling the teacher how many more examples they worked each day.

The class was found to be poor on combinations, and a great deal of stress was placed on adding short columns and long columns with carrying. Their greatest difficulty was in adding long columns. When pupils had a sum such as 37 and 7, they did not use the principle of addition in higher decades, that is, they did not realize that if 7+7=14 then 37+7=44. Both board and oral work were used along with the practise exercises to help them overcome this deficiency. This work did not cover a sufficient length of time to break fully their fixed habit, for if they were not watched they would drop back to the old way of adding.

The class seemed to dislike subtraction very much, possibly because they did not fully understand the process. Their main difficulty was in "borrowing," and this kind of example was stressed most in the practises.

Not very much stress was placed on multiplication, as the class got along very well the first few days of practise and they needed practise in other things more.

A great deal of stress was placed on both short and long division, for the class seemed to have trouble with it..

Almost every pupil's record showed improvement from the very first; several, however, seemed to be on a plateau or at a standstill through several practises; but they showed improvement in their work afterward. The entire class was not always working on the same exercise, for different ones needed special work and were given that type of work.

As can be seen from the median of Sets H and O in the Cleveland Test, Table I, the pupils needed extra work in fractions. There was no practise work in the field of fractions; so a list of fractions was made out to be used for this purpose.[6] These examples involve all cases in addition, subtraction, multiplication, and division of fractions. They were arranged on long slips of paper and these slips were marked A, B, etc., up to G, so that pupils could keep their daily records. The examples were so arranged that pupils could place them beside the paper on which they worked and do the work just opposite the example. The pupils were allowed to put the answers on the backs of the slips containing the examples after they had worked them the first time, and then the work moved off as smoothly as did the regular practise exercises.

Fifteen minutes a day for four days was used in this fraction practise. Pupils worked anywhere from two to four of these lists in a day. None of these lists required more

[5]The Studebaker Practise Exercises in Arithmetic may be obtained from the following address at the prices listed: Scott, Foresman & Company, 5 West 19th Street, New York City. Set B-One, for City Graded Schools (930 cards), $18.00; Set B-Two, for Rural Schools (250 cards), $7.50; Set B-Three, for Rural Schools (100 cards), $3.50; Set B-Four, for Individual Use (50 cards), $2.00.

[6]Thanks are due Miss Natalie Lancaster, of the State Normal School, who helped graduate these examples.

than three minutes and most of them were worked in one and one-half or two minutes.

The pupils should have had several lists of examples involving addition, subtraction, multiplication, and division all on one slip. This would have made them more careful about the signs.

The lists of examples used for this practise work are given at the bottom of this page.

Along with the practise work just described the class was given simple addition and multiplication examples by the use of mimeographed copies taken from pages 111 and 112 of *Introductory Psychology for Teachers,* by E. K. Strong, Jr. There are eighty examples on each sheet and a minute was given in which to work them in either case. This proved to be a good drill in combinations and simple multiplication. One sheet of addition and one of multiplication was given each day for twenty-seven days either before or after the other practise work. The time given to this work was not over five minutes each day. These sheets are reproduced on page 312.

CARD A	CARD B	CARD C	CARD D	CARD E	CARD F	CARD G
$\frac{3}{5} + \frac{1}{5} =$	$1\frac{1}{3} + \frac{2}{3} =$	$\frac{3}{5.} - \frac{2}{5} =$	$\frac{11}{12} - \frac{2}{3} =$	$16 \times \frac{5}{8} =$	$\frac{4}{5} \div 2 =$	$\frac{7}{8} \div \frac{9}{16} =$
$\frac{2}{3} + \frac{2}{3} =$	$2\frac{1}{2} + 1\frac{1}{4} =$	$\frac{5}{6} - \frac{1}{6} =$	$\frac{3}{4} - \frac{3}{5} =$	$\frac{3}{4} \times \frac{3}{5} =$	$\frac{1}{5} \div 4 =$	$\frac{7}{12} \div \frac{7}{8} =$
$\frac{2}{3} + \frac{1}{6} =$	$3\frac{3}{8} + \frac{1}{3} =$	$1 - \frac{1}{4} =$	$2 - \frac{2}{3} =$	$\frac{3}{4} \times \frac{5}{12} =$	$1 \div \frac{1}{4} =$	$1\frac{1}{2} \div \frac{1}{4} =$
$\frac{1}{2} + \frac{3}{4} =$	$2\frac{2}{3} + 5\frac{1}{4} =$	$\frac{2}{3} - \frac{2}{9} =$	$1\frac{3}{4} - \frac{1}{4} =$	$4 \times 1\frac{2}{3} =$	$9 \div \frac{3}{4} =$	$2\frac{2}{3} \div \frac{4}{9} =$
$\frac{3}{8} + 2 =$	$\frac{3}{4} + \frac{4}{5} =$	$\frac{7}{10} - \frac{1}{5} =$	$5\frac{5}{8} - 2\frac{3}{8} =$	$7\frac{5}{6} \times 2 =$	$\frac{1}{5} \div 3 =$	$5\frac{3}{4} \div 1\frac{1}{2} =$
$\frac{3}{4} + \frac{2}{3} =$	$\frac{1}{2} + \frac{1}{8} + \frac{3}{4} =$	$\frac{1}{3} - \frac{1}{8} =$	$5\frac{3}{5} - 1\frac{4}{5} =$	$\frac{2}{3} \times 1\frac{3}{4} =$	$\frac{1}{2} \div 6 =$	$\frac{5}{12} \div \frac{3}{4} =$
$\frac{2}{5} + \frac{5}{6} =$	$\frac{2}{3} + \frac{1}{6} + \frac{2}{9} =$	$\frac{1}{4} - \frac{1}{5} =$	$3\frac{1}{3} - 1\frac{2}{3} =$	$\frac{5}{7} \times 2 =$	$6 \div \frac{3}{5} =$	$6\frac{7}{8} \div 7\frac{1}{2} =$
		$\frac{5}{6} - \frac{3}{8} =$	$12 - 5\frac{5}{9} =$	$\frac{1}{3}$ of $\frac{3}{4} =$	$\frac{5}{6} \div \frac{2}{3} =$	$1\frac{7}{8} \div 2\frac{1}{2} =$
				$\frac{3}{4} \times \frac{8}{9} =$		
				$2 \times 2\frac{1}{2} =$		
				$5 \times 2\frac{1}{10} =$		
				$1\frac{1}{2} \times 2\frac{1}{2} =$		

B TEST—ADDITION

Name_____ Age____ Grade____

3	0	3	11	12	9	7	6	4	2
11	8	2	7	4	0	8	5	8	1
8	5	8	12	6	9	2	11	12	0
12	1	0	5	10	5	10	3	1	7
1	10	4	9	6	7	12	1	7	6
8	7	12	1	6	3	9	4	12	1
7	6	4	9	10	2	1	10	8	5
2	11	7	6	3	6	9	6	3	10
3	8	4	5	6	3	7	10	8	0
3	4	10	11	3	2	5	3	5	6
11	7	0	9	11	4	8	5	8	6
4	7	11	10	11	0	8	4	9	7
3	10	3	0	12	1	9	1	4	5
12	1	7	2	8	5	9	0	9	0
12	5	2	11	2	0	2	4	10	2
11	9	2	8	5	12	11	4	11	9

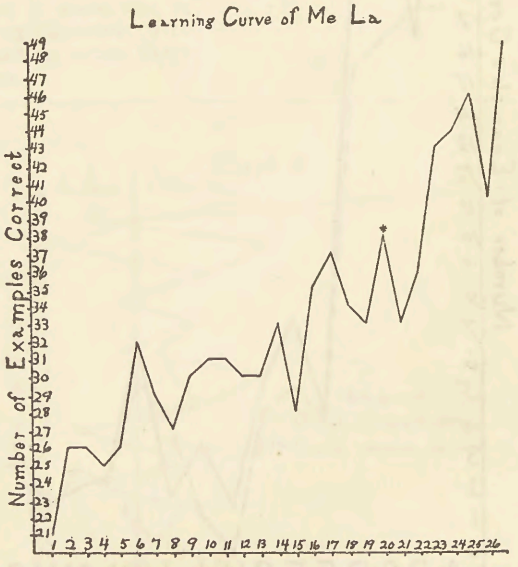
BX TEST—MULTIPLICATION

Name_____ Age____ Grade____

3	0	3	11	12	9	7	6	4	2
11	8	2	7	4	0	8	5	8	1
8	5	8	12	6	9	2	11	12	0
12	1	0	5	10	5	10	3	1	7
1	10	4	9	6	7	12	1	7	6
8	7	12	1	6	3	9	4	12	1
7	6	4	9	10	2	1	10	8	5
2	11	7	6	3	6	9	6	3	10
0	8	10	7	3	6	5	4	8	3
3	4	10	11	3	2	5	3	5	6
11	7	0	9	11	4	8	5	8	6
4	7	11	10	11	0	8	4	9	7
3	10	3	0	12	1	9	1	4	5
12	1	7	2	8	5	9	0	9	0
12	5	2	11	2	0	2	4	10	2
11	9	2	8	5	12	1	4	11	9

The pupils' progress in both of the lists was very marked. After a great deal of practise one pupil was able to work seventy-eight addition examples correctly several times.

One pupil in the class always led in multiplication, but never showed much improvement in addition. After having him add aloud it was found that he still used fingers or imaginary marks in the case of 17+8; that is, saying seventeen and counting eight by ones. On the twentieth day his attention was called to this mistake, and even though it was a difficult thing, he set about breaking this habit. This pupil is very much pleased with the progress that he made each day after he began using the other method of adding. A learning curve of this individual's work may be seen in the following graph:

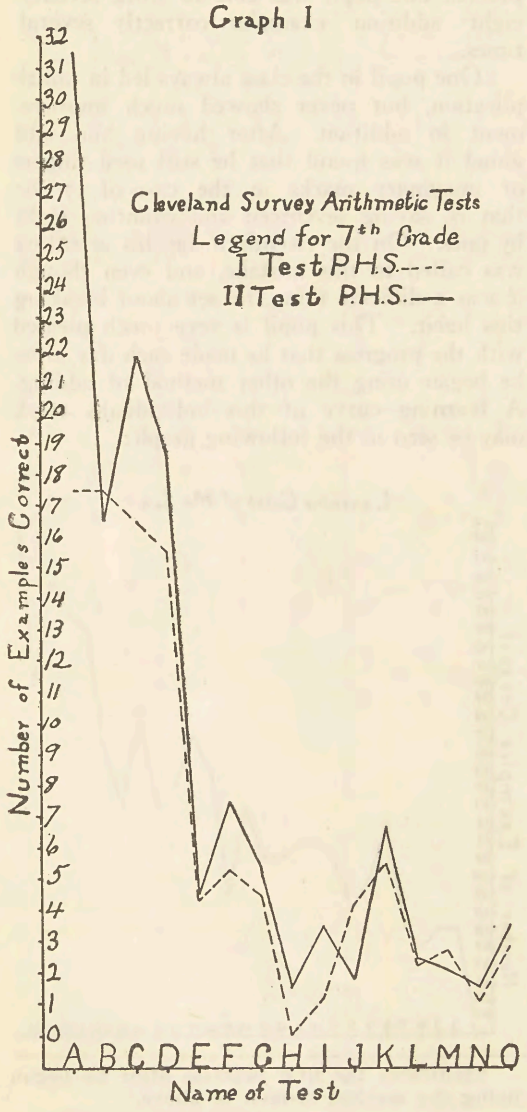


*Indicates the first practise after he began using the method spoken of above.

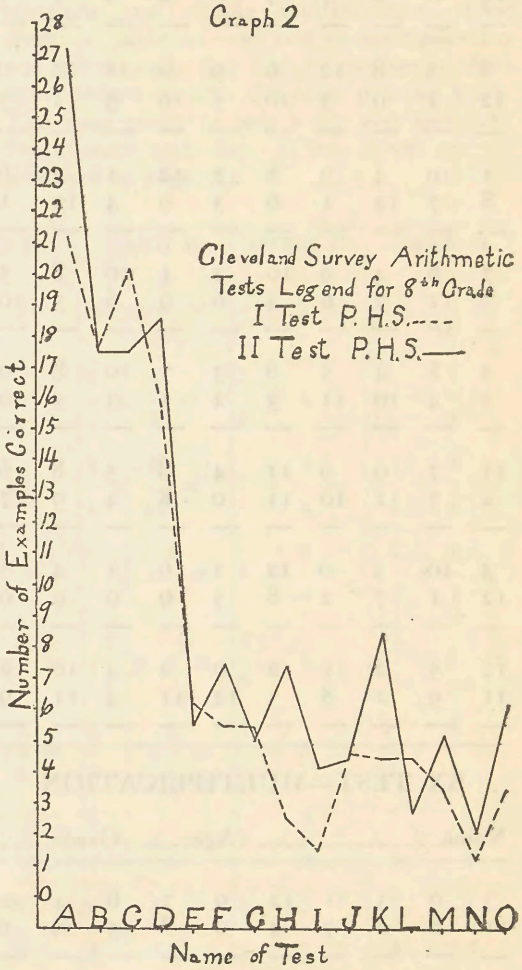
This practise work helped the pupils in both speed and accuracy, and the work of problems has become more interesting to them because they thoroughly understand the mechanical side of the work. They have also learned to work with ease, even though they are being timed and their work is watched. Several pupils that were formerly always quiet now never fail to talk about their work when they have a chance. The pupils would rather have missed almost anything else during the day than their practice period, which shows that they were intensely interested in it.

On April 20, 1921, the Cleveland Survey Arithmetic Test was given again to the seventh and eighth grade of the Pleasant Hill School, the seventh grade having had the practise work, while the eighth grade had had no special attention.

Graph 1



Graph 2



As can be seen from Graphs 1 and 2 both classes show improvement in some sets, and in others there was no improvement.

Tables IV and V show the medians of the first and second tests compared. Where there was improvement it is indicated by a plus sign and no improvement is indicated by a minus sign.

The seventh grade does not show so much improvement as might be expected, but some of the pupils were very irregular attendants, and this fact has hindered their progress. The eighth grade has not had this difficulty to overcome. Even though these results of

TABLE IV

Showing the seventh grade's class medians in Cleveland Survey Tests before and after special training, with explanations and tentative decisions

	Name of Set	Class Median Test I	Class Median Test II	Amount Test I median is above or below Test II	EXPLANATION	TENTATIVE REMARKS
Addition	A	17.5	31.5	+14.0		Drill in combinations pays.
	E	4.35	4.5	+ 0.15		
	J	4.1	1.8	— 2.3		
	M	2.75	2.16	— 0.59		
Subtract'n	B	17.5	16.5	— 1.0		
	F	5.35	7.5	+ 2.0		
Multiplication	C	16.6	21.7	+ 5.1		
	G	4.5	5.4	+ 0.9		
	L	2.37	2.5	+ 0.13		
Division	D	15.5	18.5	+ 3.0		
	I	1.25	3.5	+ 2.25		
	K	5.5	6.75	+ 1.25		
	N	1.16	1.5	+ 0.34		
Fractions	H	----	1.5	+ 1.5	Mistakes in Test II were not in method but in carelessness with signs, that is, adding when there was a minus sign.	
	O	2.8	3.5	+ 0.7		

practise are not so marked in all cases, there is enough gain shown to prove that these practise exercises are really worth while.

It is confidently believed that the progress made would have shown a proportionate increase if there had been a larger time available for use of the Studebaker Practice Exercises; it should be remembered that the period of this experiment lasted only from February 3 to April 20.

The eighth grade shows up very well considering that it had not had any special training. It is interesting to note that out of fifteen sets nine show improvement.

In Table VI may be seen the improvement of each pupil in the seventh grade. The first score is that of the Cleveland Sur-

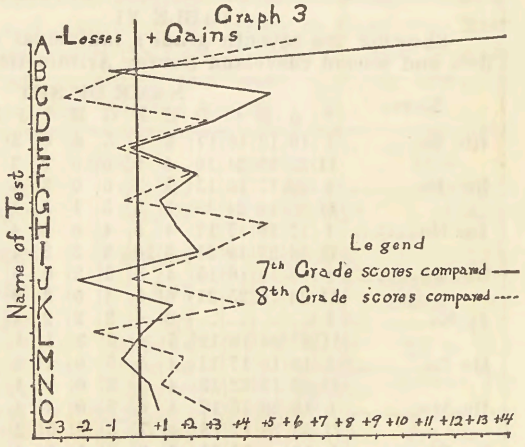


TABLE V

Showing the eighth grade's class medians in Cleveland Survey Tests compared along with explanations and tentative suggestions.

	Name of Set	Class Median Test I	Class Median Test II	Amount Test I median is above or below Test II	EXPLANATION	TENTATIVE REMARKS
Addition	A	21.25	27.37	+ 6.12		
	E	6.25	5.5	— 0.75		
	J	4.75	4.5	— 0.25		
	M	3.5	5.25	+ 1.75		
Subtraction	B	17.75	17.5	— 0.25		Improvement in the eighth grade is not as general as in the seventh grade.
	F	5.5	7.5	+ 2.0		
Multiplication	C	20.25	17.5	— 2.75		
	G	5.5	5.0	— 0.5		
	L	4.5	2.75	— 1.75		
Division	D	15.75	18.5	+ 2.75		
	I	1.5	4.16	+ 2.66		
	K	4.5	8.5	+ 4.0		
	N	1.25	2.16	+ 0.91		
Fractions	H	2.5	7.5	+ 5.0	Improvement is very marked.	
	O	3.5	6.25	+ 2.75		

TABLE VI

Showing the seventh grade's individual scores on the first and second Cleveland Survey Arithmetic Tests:

Name	Test	NAME OF SET A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Ru Be	I	19	12	16	17	3	5	5	6	0	3	8	2	0	1	5
	II	31	19	21	16	4	9	5	6	2	3	9	2	3	2	7
Ru Bo	I	22	17	16	13	5	3	6	0	3	4	7	1	2	0	3
	II	35	14	24	20	3	8	5	1	3	1	9	5	2	3	1
Do Ha	I	17	18	17	17	4	5	4	0	1	4	2	2	5	0	1
	II	34	22	19	21	3	10	5	2	3	1	9	3	2	1	5
Ne Ke	I	13	18	16	15	4	5	3	2	0	0	2	1	3	1	3
	II	28	15	25	21	6	5	4	0	3	0	1	2	1	0	2
Jo Ki	I	--	--	--	--	2	4	3	2	2	4	4	0	0	1	2
	II	27	14	18	12	5	4	3	3	1	1	5	2	1	0	1
Me La	I	13	10	17	11	4	5	5	0	1	2	5	4	1	1	2
	II	23	12	22	13	4	5	5	0	0	1	5	2	1	0	2
Ra My	I	18	20	16	17	4	6	3	0	4	4	6	2	4	2	2
	II	39	19	13	18	4	7	5	0	5	2	6	1	1	1	3
Pa Th	I	16	9	15	11	2	3	3	1	0	4	1	2	2	0	2
	II	24	16	21	14	5	6	5	2	0	3	6	1	2	1	4

vey Tests given on February 3, 1921, the second score is that made on the test when repeated April 20, 1921.

Table VII shows the scores of the eighth grade for the first and second Cleveland Survey Tests.

Graph 3 shows the comparative gains and losses of the seventh and eighth grades; that is, the seventh grade shows an improvement of 14.0 in set A, while the eighth grade shows an improvement of 6.21. In set B there is a loss in each case of 1.0 and 0.2. The rest of the sets are compared in like manner.

CONCLUSIONS

I. Measurements of achievement are needed.

II. Measurements are guides in improvement of instruction.

A. For the teacher—

1. They show class weaknesses.
2. They are the guide in practise work.
3. Out of the test and practise work come topics for teaching.

B. For the pupil—

1. They show individual weaknesses.
2. They give the pupil an incentive to work to reach a standard score.

VADA MILLER

TABLE VII

Showing the eighth grade's individual scores on the first and second Cleveland Survey Arithmetic Tests:

Name	Test	NAME OF SET A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Ha Ac	I	16	18	13	15	5	6	4	--	--	--	--	--	--	--	6
	II	21	17	10	18	6	7	5	8	3	2	7	1	3	1	5
Sy La	I	26	21	30	15	6	5	5	0	0	5	4	4	4	0	3
	II	27	17	17	15	7	7	5	3	2	5	9	2	5	1	4
Al My	I	18	17	18	15	3	3	5	4	2	3	1	3	3	1	1
	II	27	18	19	19	2	6	7	7	4	1	8	2	1	2	2
Ed Sh	I	21	20	20	21	7	7	5	2	3	6	9	5	2	2	6
	II	27	15	15	24	5	9	5	12	4	6	11	6	6	2	6
Ja Sh	I	21	17	17	18	6	9	4	12	0	4	6	3	4	0	0
	II	27	20	15	18	5	9	5	8	2	4	7	4	5	2	8
Re Sw	I	18	14	20	14	5	2	7	1	1	4	1	5	1	1	4
	II	22	15	23	14	4	6	6	0	4	3	5	0	1	0	6

II

FIFTEEN YEARS OF PROGRESS

On July 6, 1869, the people of Virginia adopted a state constitution which provided the particulars for the statewide system of public free schools for the commonwealth until 1902.

The convention which formulated this constitution consisted of 105 members comprising 33 conservatives and 72 radicals, the latter including 24 negroes, along with 14 Virginians, 26 Northerners, 1 South Carolinian and 6 members from some part of the British Dominions.

Anyone familiar with the history of reconstruction in Virginia will know that any product from the hands of such a body as this was doomed to meet opposition on the part of Virginia as soon as she recuperated sufficiently to assume the aggressive. From 1870, therefore, until the adoption of our present constitution in 1902, not only did the people fail properly to support and patronize the public schools, but so general was the feeling, that a state treasurer did not hesitate to divert public school funds to other purposes, feeling that he was rendering the state a patriotic service.

After the adoption of a new constitution in 1902 there followed the famous educational campaign of May, 1905, which represented the culmination of a series of efforts at an educational revival extending as far back as 1898.

Since the school year of 1905-'06, therefore, we have experienced an "Educational Renaissance" in Virginia marked with unprecedented progress. The following statistics and statements are given to those who have not either the time or the inclination to work out in detail this most thrilling story of modern Virginia history.

YEAR	1875	1890	1905	1920
School Population	482,789	652,045	580,618	658,926
Number Pupils Enrolled	184,486	342,269	361,772*	505,190
Number of Pupils in Average Daily Attendance	103,927	198,290	215,205	351,171
School Term in Months	5.59	5.91	6.4	Counties 7.2 Cities 8.9
Number of Teachers	4,262	7,523	9,072	14,271
Ratio Men to Women	27 to 15	31 to 44	21 to 70	1.5 to 12.7
Monthly Salaries—Men	$33.52	$31.69	$36.86	Approx. $70
" " —Women	$28.71	$26.61	$28.11	
Value of School Property	$757,181	$2,235,085	$4,297,625	$22,900,000
Total Expenditures for All Purposes	$1,021,396	$1,604,508	$2,432,102	$13,100,000

*Figures for 1875 and 1890 apply to ages of 5 to 21 years; those of 1905 and 1920 to ages of 7 to 20 years.